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CAUSE NO. \_\_\_\_\_

<b>DONALD BRAXTON, DONALD</b>	§	<b>IN THE DISTRICT COURT OF</b>
<b>MALLARD, INDIVIDUALLY</b>	§	
<b>AND AS REPRESENTATIVE OF THE</b>	§	
<b>ESTATE OF JERVIE MALLARD, SR.,</b>	§	
<b>DECEASED,</b>	§	
<i>Plaintiff,</i>	§	
	§	
<b>VS.</b>	§	<b>HARRIS COUNTY, TEXAS</b>
	§	
<b>UNION PACIFIC RAILROAD</b>	§	
<b>COMPANY, PASTOR, BEHLING &amp;</b>	§	
<b>WHEELER, L.L.C., AND</b>	§	
<b>ENVIRONMENTAL RESOURCES</b>	§	
<b>MANAGEMENT SOUTHWEST, INC.,</b>	§	
<i>Defendants.</i>	§	<b>_____ JUDICIAL DISTRICT</b>

**DECLARATION OF PHILIP B. BEDIENT**

I, Philip B. Bedient, hereby declare as follows:

1. I am a licensed professional engineer in the State of Texas and have been licensed in Texas since 1979. My state engineer's license number is 45626. I am knowledgeable and actively engaged in the practice of civil/environmental engineering in the State of Texas, including in the area of groundwater contamination. I am authorized to make this declaration. I make this declaration of my own personal knowledge, and if called as a witness herein, could and would competently testify to the matters asserted in this declaration. The opinions made herein are based on my knowledge, skill, experience, education, training and practice in the area of civil/environmental engineering, including in the area of groundwater contamination.
2. The opinions expressed herein are based on my background, training, and experience as Texas licensed Professional Engineer and Professional Hydrologist with a B.S. Physics, University of Florida, Gainesville, Florida, 1969, M.S. Environmental Engineering, University of Florida, 1972 and Ph.D. Environmental Engineering Sciences, University of Florida, 1975 and as a Herman Brown Professor of Engineering - Civil and Environmental Engineering- Rice University - July 2001 to present; Professor - Environmental Engineering - Rice University - 1986 to 2001; Professor and Chair - Department of Environmental Science and Engineering, Rice University, Houston, Texas, 1992 – 1999; Associate Professor - Environmental Engineering – 1980 – 1986; Assistant Professor - Environmental Engineering – 1975 - 1980. (**Ex. A-1, P. Bedient C.V.**). I also have direct experience actively working on environmental contamination sites throughout the United States, including the state of Texas. Specifically, I have actively worked on numerous sites involving creosote contamination.

**EXHIBIT A**

3. I reviewed and referenced the following documents in forming this opinion:
  - A. Amended Party Status and Technical Comment Letter, Harris County Attorney, June 18, 2020.
  - B. TCEQ Regulatory Guidance. Risk-based management of NAPL. 2008. TCEQ Remediation Division. RG-366/TRRP-32.
  - C. ERM and PBW reports submitted to the TCEQ
  - D. Plaintiffs' Draft Petition
4. My understanding of the facts are that engineers from Defendants Environmental Resources Management Southwest, Inc. (ERM) and from Pastor, Behling & Wheeler, LLC (PBW) were retained by Union Pacific Railroad Company (UPRR) to provide engineering services in connection with the identification and remediation of creosote contamination at the UPRR site near Kashmere Gardens in east Harris County, known as the UPRR's Englewood Rail Yard, located at 4910 Liberty Road, Houston, Texas 77026 ("Rail Yard"). This site was a creosote wood treatment plant operated by Union Pacific from at least 1950 to 1985 and located in the Rail Yard. For decades, millions of gallons of creosote were heated in open air vats and ditches and dumped at the Rail Yard, which directly caused the contamination of Kashmere Gardens, including the Plaintiffs' properties (see **Figure 1**). For years Union Pacific and its consultants ERM and PBW failed to address, remediate, and/or warn of the real risks of creosote exposure. Soil samples and monitoring wells in the Rail Yard, Kashmere Gardens, and the Fifth Ward continue to test positive for unsafe levels of creosote and toxic chemicals. UPRR, under the guidance of ERM and PBM, has applied for permits through the Texas Commission on Environmental Quality ("TCEQ") to "clean up" portions of the creosote and toxic chemicals. However, Defendants' delays and half measures to remediate this problem directly caused the continued spread of an underground plume of creosote sludge known as a dense non-aqueous phase liquid ("DNAPL"). The heavy nature of the DNAPL causes it to sink into the ground and spread outward to the surrounding groundwater, soil, and air far beyond the property line of the Rail Yard. This process is ongoing and continuous.
5. Based on my understanding of the facts, and having reviewed the documents referenced herein, I have the following opinions.
6. **ERM and PBW engineers failed to develop and refine a conceptual site model that reasonably represented the key hydrogeologic features of the site, in order to develop an appropriate remediation plan**

Engineers from ERM and PBW have failed to develop a reasonably reliable Conceptual Site Model (CSM) that captures the key hydrogeologic features of the site and the major routes of chemical exposure to the adjacent community, i.e. Kashmere Gardens (**Figure 1** shows the location of this site and this adjacent community). Furthermore, these engineers also failed to update and refine their CSM as more data was collected that showed the need for such refinement. The development and refinement of a reasonably reliable CSM is a key step in the regulatory process, through either the federal Resource Conservation and Recovery Act (RCRA) or the state's Texas Risk Reduction (TRR) program. In modern

remediation engineering practice, the CSM should capture the important information about site contamination in a written or graphical form. Importantly, it should evolve as data are collected over time. The CSM should also serve as a platform for systematically identifying and closing data gaps and moving the remediation processes forward. In the work of ERM and PBW, their CSM is static and does not appear to have changed to any degree since the mid-1990's, even though additional data was collected showing their CSM was not accurately representing the key hydrogeologic features of the site and exposure routes to the surrounding areas.

As an example, the engineers' CSM was developed, and has been maintained, as a grossly oversimplified and incorrect representation of the site hydrogeology. In reports submitted to the Texas Council of Environmental Quality (TCEQ), ERM and PBW have characterized the subsurface at the site and adjacent areas as a "layered cake" with three distinct transmissive zones (termed A-TZ, B-TZ, and C-TZ) separated by distinct layers of clays and silty clays that are significantly less permeable (see **Figure 2** showing the engineers' CSM and its distinct layers). This gross misrepresentation in their CSM remained, even after regular data collection of groundwater flow direction, potentiometric elevations and cone penetrometer testing (CPT) data showed at a minimum that the A-TZ and B-TZ zones are clearly connected by having the same potentiometric surface (see **Figure 3** showing the same potentiometric elevations in zones A-TZ and B-TZ). The recent memo from Harris County also presents evidence of the site hydrogeology conflicting with these engineers' CSM representation, including that it is likely that all of these layers are connected, separated only by discontinuous stringers of less permeable materials<sup>1</sup>. The absence of a more realistic CSM has been the responsibility of these 2 engineering firms for decades. The data is available, with over 100 monitoring wells (and associated well logs) having been installed at the site, as well as a large amount of CPT data. In modern engineering practice, this information would be used to construct and calibrate a scientifically sound Conceptual Site Model (CSM) of the hydrogeology of the site. As stated in the Harris County memo<sup>2</sup>, this would include visualization and mapping using common tools such as EarthVision™ or Rockware™.

In the absence of a reliable CSM of the subsurface, the key steps needed to understand how to close the site are severely hampered. These include the effectiveness of remedial decisions for site closure and assessing routes of exposure to the adjacent community. These tools and models are not new and represent the standard of care for sites with contaminated groundwater. The absence of a reasonably accurate and refined CSM supported by quantitative data from the beginning is a clear failure by these firms, which has continued for decades after this process began.

7. **Engineers from ERM and PBW failed to fully identify additional areas of potential contamination, such as the Englewood Intermodal Yard, in order to develop an appropriate remediation plan**

<sup>1</sup> Amended Party Status and Technical Comment Letter, Harris County Attorney, June 18, 2020, page 3

<sup>2</sup> Amended Party Status and Technical Comment Letter, Harris County Attorney, June 18, 2020, page 4

In the RCRA and TRR process, identification of additional areas of investigation should occur as the site process progresses and new information becomes available, particularly on complex sites like this one. These additional areas fall into 2 categories: locations where solid wastes were known to be stored and used (i.e. solid waste management units or SWMUs), and areas impacted by releases of solid wastes, but not places where solid wastes were known to be stored (i.e. areas of concern or AOCs). However, here we do not see any change in the site process when the SWMUs and AOCs were identified by ERM and PBW for the site.

For example, the recent Harris County memo draws attention to the large area to the south, the Englewood Intermodal Yard<sup>3</sup>. Historical aerial imagery (1944, 1953, and 1978) shows the presence of a number of areas of additional interest, including 3 large aboveground storage tanks (ASTs) in the Englewood Intermodal Yard (see **Figure 4** showing aerial imagery of these ASTs). Past non-aqueous phase liquid (NAPL) detections and waste seeps in this area, identified in reports from ERM and PBW, showed contamination in this area. The inability of these engineering firms to identify the Englewood Intermodal Yard as a SWMU (or subdividing this area into some combination of SWMUs and AOCs) is an obvious error in site management. By not initiating investigation in the Yard, this area is not formally identified as a SWMU or AOC, and any cleanup progress in this area would not appear in the specific reporting requirement, i.e., the Affected Property Assessment Report, that informs the public on the progress of clean-up.

**8. Engineers from ERM and PBW have failed to characterize, assess and develop a plan to mitigate dense non-aqueous phase liquids (DNAPL) at the site as required by TRR**

Risk-based NAPL guidance prepared by TCEQ outlines the steps required to assess and mitigate these contamination sources<sup>4</sup>. These include management provisions to abate explosive conditions, to prevent or stabilize the migration of NAPL zones, to abate aesthetic impacts or nuisance conditions, and to abate the toxic threat to human or ecological receptors, due to the contact of NAPL with Class 2 groundwater and the contact of NAPL with soil gases. ERM and PBW have failed to assess and develop a plan to mitigate NAPL at the site according to the requirements of the TRR. Specifically, these engineering firms have:

- a. **Failed to properly characterize the NAPL.** Despite the knowledge of the presence of NAPL extending back to the late 1990's from the collection of soil borings and soil penetrometer testing, ERM and PBW have not performed even the most basic chemical and physical characterization of the NAPL at the site. This chemical and physical characterization is critical to determining the potential completion of exposure pathways to the adjacent community, both for the NAPL via the groundwater route and the NAPL via the soil gas route. Without this information, it was impossible to determine whether human health risks existed for the community in the ~25 years since

<sup>3</sup> Amended Party Status and Technical Comment Letter, Harris County Attorney, June 18, 2020, page 2

<sup>4</sup> TCEQ Regulatory Guidance. Risk-based management of NAPL. 2008. TCEQ Remediation Division. RG-366/TRRP-32

NAPL was identified on site. In some cases, while suspected NAPL was identified by CPT-ROST techniques at certain depths, chemical characterization samples were only taken at other depths in the soil profile, completely avoiding the characterization of the NAPL zones<sup>5</sup>. While the assumption is that all of the NAPL is dense creosote, based on historical land use, the presence of other NAPL sources on the site (e.g. naptha, extenders such as Bunker C, gasoline, diesel, other oils) is documented in site information. In addition, the weathering of the creosote NAPL in the vadose and saturated zone over the years since spillage is evidence that NAPL characterization should have been a key first step. Even under the most basic rule of thumb, that NAPL is suspected when compounds are present at >1% of water solubility, there is a total absence of the characterization of NAPL in the site record.

- b. Failed to systematically assess the presence and migration of NAPL across the site. While ERM and PBW have collected a significant amount of data on the presence of NAPL at the site, there is no evidence from the reports prepared by these engineering firms of any consistent, systematic effort to characterize the presence and migration of NAPL. These steps include identifying the NAPL contaminated zones in 3-dimensions across the site, assessing their change over time, and determining their mode of migration and release to other media. This is critical to assess the potential for completion of exposure pathways to the adjacent community. While some maps have been prepared of 2-D transects capturing the presence of NAPL at the northeastern and western property boundaries<sup>6</sup> (see **Figure 5** showing NAPL at property boundaries and beyond), the interpretation presented is contradictory. For example, while on the one hand these engineers are opining that carbonate seams in the subsurface may be effective mitigators for DNAPL spread, there is another document at the same time showing the migration of DNAPL deeper in the subsurface, indicating that these carbonate seams are not effective mitigators for DNAPL spread. There are several references in recent documents to pilot studies on DNAPL recovery at this site, but no engineering details are in the public record to date.
- c. Failed to develop a plan to mitigate NAPL migration from occurring. To date, I am unaware that a remediation plan for the NAPL across the site and beyond has been initiated. Migration of DNAPL has likely continued during this period of inaction, both vertically into the saturated zone and through the vadose zone in the soil gas. Remarkably, no soil gas surveys have been performed at the site by these firms despite the documented presence of NAPL in the upper unsaturated (vadose) zone. As the Harris County memo recommends, this survey of soil gas should be conducted as soon as possible. Establishing the magnitude of these releases is important in order to develop a plan of the remedial approach to be taken, and to determine what types of controls would need to be built and maintained to prevent exposures to the community. But the delay in addressing this route of exposure over these many years has created exposures that have already occurred to the adjacent property owners. These type of emissions from surface soils are most harmful since they impact the air in the adjacent

<sup>5</sup> Amended Party Status and Technical Comment Letter, Harris County attorney, June 18, 2020, page 3-4

<sup>6</sup> Amended Party Status and Technical Comment Letter, Harris County attorney, June 18, 2020, Figure 10

community. The inaction by these firms has contributed to these past and still ongoing exposures.

9. **Even though adjacent properties were impacted by the offsite movement of contamination, ERM and PBW failed to establish the full extent of community impacts or develop actions to completely stop those releases**

Adjacent properties in the Kashmere Garden neighborhood have been impacted by various releases from the site. These include exposures from contaminated water and vapors from contaminated soil, subsoil and groundwater originating from DNAPL migration and chronic releases of individual chemicals from the site. These impacts are still ongoing due to the inability of these engineering firms to fully delineate and then develop and implement a plan to stop these releases. Affected property maps have been prepared as part of the TRR program (see **Figure 6** showing Affected Properties). These maps acknowledge the movement of contaminant plumes in the A- and B- transmissive zones (A-TZ and B-TZ) to the north and northeast beyond the site property boundaries and under existing residences. Contaminants in these plumes are also potentially being intercepted by a sewer line or abandoned stream channel taking them even further to the northeast, which will facilitate their further movement into the community. The full understanding of these impacts is limited because of these engineers' overly simplistic and inaccurate analysis of the subsurface characteristics, as described above.

These Affected Property Maps also indicate impacted soil and subsoil, though, to date, the impacted area is only considered to be onsite (**Figure 6**). Yet details of individual compounds show how limited the offsite effort has been to identify their presence and extent (**Figure 6**). These include only a few data points directly along the fence line and a few along the proposed groundwater flow path. DNAPL movement, impacting the soil and subsoil, will not necessarily follow groundwater flow paths, so focusing solely on those areas is insufficient. The ongoing impacts on soil and subsoil are yet unknown and won't be understood until DNAPL is delineated. Diagrams representing the CSM, recently prepared, acknowledge the movement of DNAPL into the neighborhood (**Figure 6**), though the extent of migration, the ongoing rate of DNAPL migration and the impacts on soil gases are unknown.

The CSM and the Affected Property Maps produced to date (**Figures 2 and 6**, respectively) acknowledge that the contaminants have left the property, both in the DNAPL and in dissolved form. Despite the engineering failures described above and in the memo from Harris County, the movement of contamination into the community is not disputed. While this should have created a sense of urgency to fully delineate the DNAPL extent and to mitigate those impacts on the community, an integrated response plan remains undefined. The work of these engineering firms were in partnership with UP in slow-walking this cleanup over decades. This is despite reliable delineation techniques and remedies that were available and applied at other sites. Certainly, unnecessary contaminant exposures to the community occurred during this time.

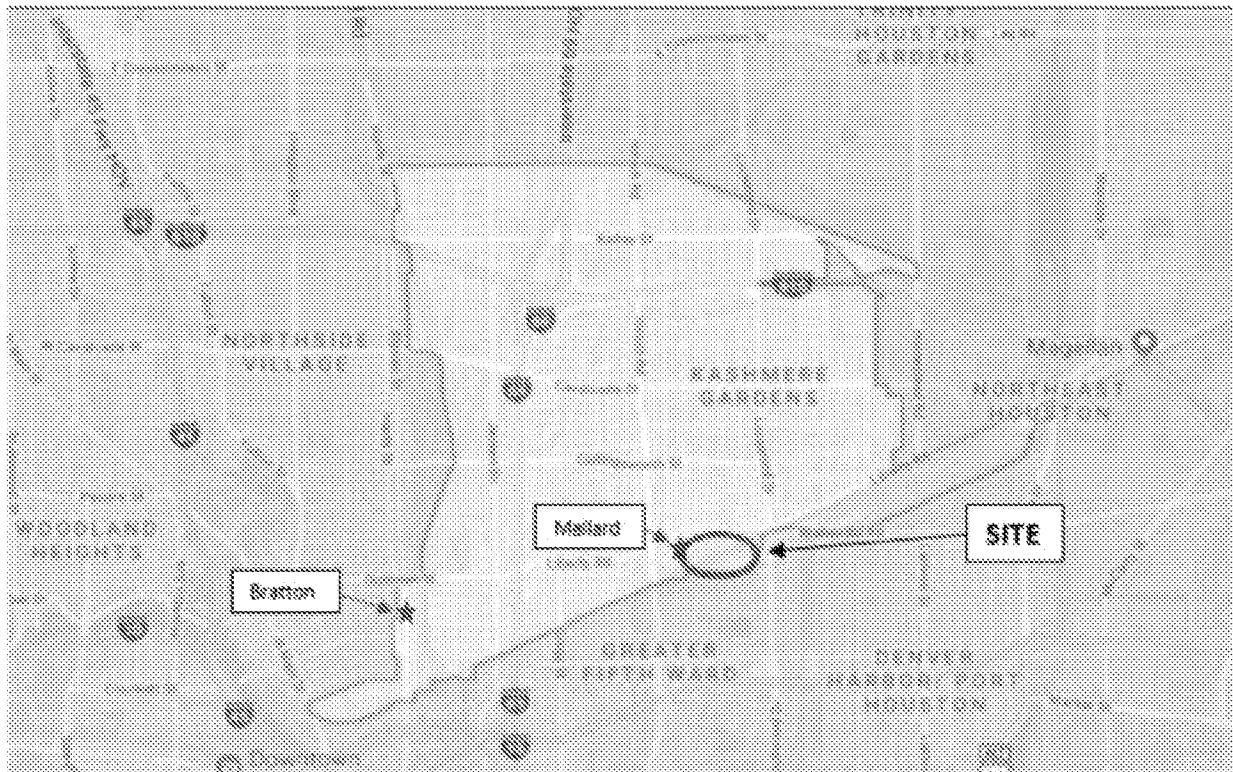
My name is Dr. Philip B. Bedient. My date of birth is Jan. 13, 1948, and my work address is Rice University/MS – 317, 6100 Main Street, Houston, Texas 77005. I declare under penalty of perjury that the facts stated in this document are true and correct.

Executed in Harris County, State of Texas, on May 19, 2021.

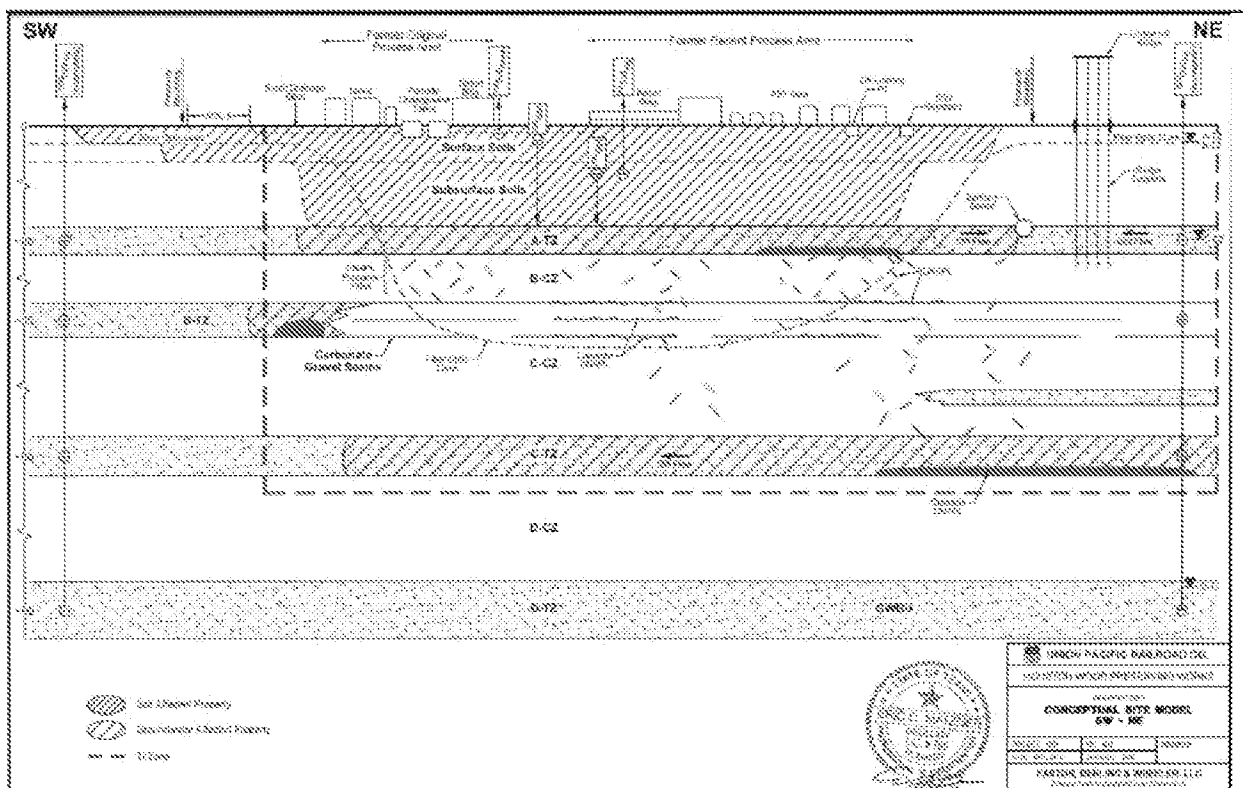
  
Philip P. Bedient

May 19, 2021

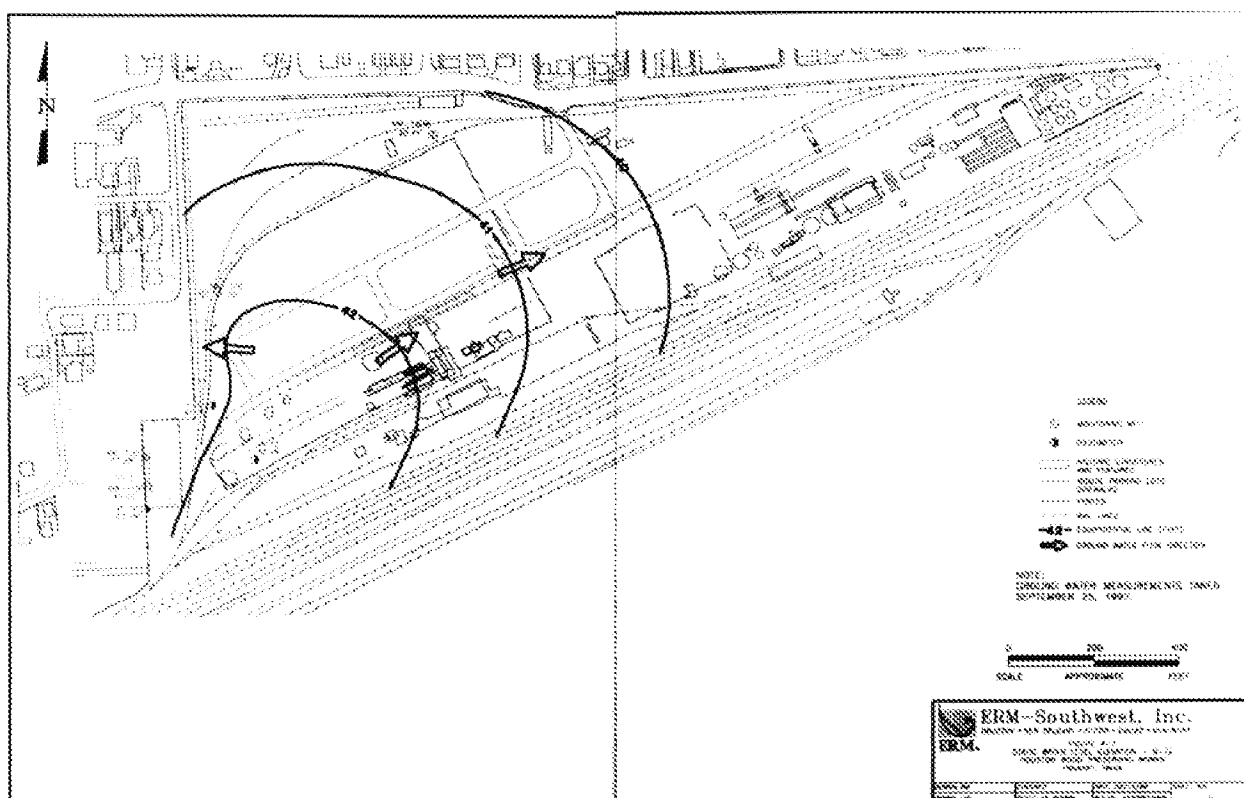




**Figure 1. Location Map of Site, Plaintiffs and Surrounding Communities**



**Figure 2. CSM showing “Layered Cake” Hydrogeology Under Site**



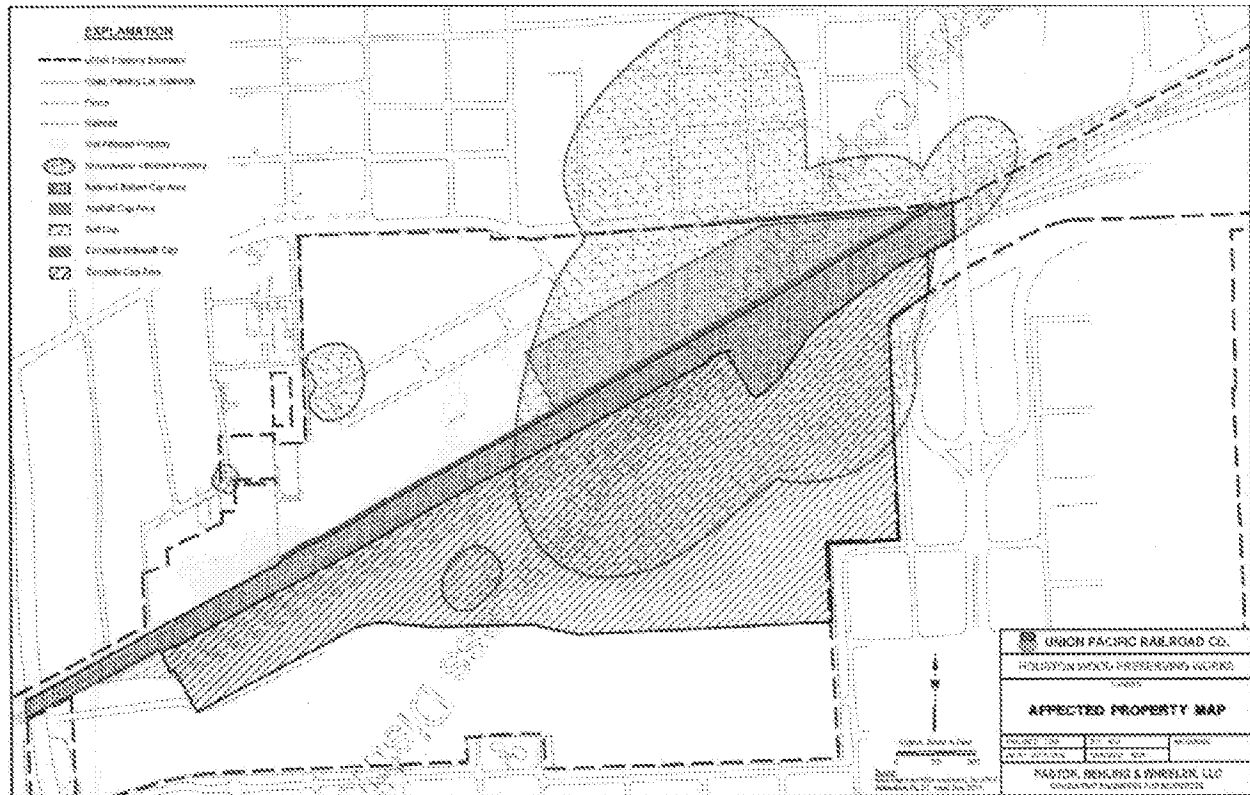
## EXHIBIT A



**Figure 4. 1944 Aerial showing Above-Ground Storage Tanks in Englewood Intermodal Yard**



**Figure 5. Observed NAPL Thickness in the Vadose Zone in and around Site**



**Figure 6. “Affected Property Map” showing Soil and Groundwater Impacted Areas**



January 2020

**Philip B. Bedient, Ph.D., P.E.**  
**Curriculum Vitae**

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**EDUCATION:**

B.S. Physics, University of Florida, Gainesville, Florida, 1969  
M.S. Environmental Engineering, University of Florida, 1972  
Ph.D. Environmental Engineering Sciences, University of Florida, 1975

**PROFESSIONAL EXPERIENCE:**

Chair – Department of Civil and Environmental Engineering, Rice University, Houston, TX –  
July 2019 to present  
Herman Brown Professor of Engineering - Civil and Environmental Engineering - Rice  
University - July 2001 to present.  
Professor - Environmental Engineering - Rice University - 1986 to 2001.  
Professor and Chair - Department of Environmental Science and Engineering, Rice University,  
Houston, Texas, 1992 - 1999.  
Associate Professor - Environmental Engineering – 1980 - 1986.  
Assistant Professor - Environmental Engineering – 1975 - 1980.

**SCIENTIFIC SOCIETIES:**

American Society of Civil Engineers  
American Institute of Hydrology  
American Water Resources Association  
Association of Environmental Engineering Professors  
American Academy of Water Resources Engineers  
American Geophysical Union

**HONORS:**

Diplomate - Water Resources Engineer, American Academy of Water Resources Engineers  
(2008)  
C.V. Theis Award from the American Institute of Hydrology (April 2007)  
Fellow – American Society of Civil Engineers (April, 2006)  
Endowed Chair – Herman Brown Professor in Engineering (July, 2001)  
Shell Distinguished Chair in Environmental Science (1988-93)  
Phi Beta Kappa

**PROFESSIONAL COMMITTEES:**

Expert Panel – “Impacts of Climate Change on Transportation Systems and Infrastructure in the  
Gulf Coast” USDOT and USGS, 2005 - 2006  
TS Allison Recovery Project - Technical Advisory Committee - 2002-2003  
Harris County Flood Control District - Brays Bayou Federal Project Com – 1998- 2002  
National Academy of Engineers (National Research Council)

**EXHIBIT A**

Committee on DoE Environmental Management Technologies (CEMT) - 1995-96  
 Committee on In-Situ Bioremediation - 1992-93

#### **UNIVERSITY COMMITTEES:**

Dean Review Committee – Department of Architecture, 2019  
 Undergraduate Curriculum Committee, 2005-2019  
 Accreditation (ABET/SACS) Committee, 2005-2019  
 Events and Reception Committee (Chair) 2012  
 Mentorship Committee 2012  
 Space Planning Committee, 2005-2019  
 CEE Student-Group Advisors 2012  
 BSCE Advisor 2007-2019  
 Center for Civic Engagement Committee, 2007-2012  
 Parking Committee, 1998-2012  
 Search Committee, Civil and Environmental Engineering, (2001-2002)  
 Chair, Dean of Engineering Search Committee, (1988)  
 Computer Committee, Athletics Committee, 1998-2000  
 Advisory Council, School of Engineering,

#### **LICENSES:**

Professional Engineer, State of Texas, Environmental Engineering (45626)  
 Professional Hydrologist, American Institute of Hydrology

#### **RESEARCH INTERESTS:**

**Flood & Surge Mitigation** As the director of the Severe Storm Prediction Center (SSPEED) at Rice University (since 2007) Dr. Bedient leads a team of five universities and 15 investigators from Gulf Coast universities dedicated to improving storm prediction, education, and evacuation from disaster. The Center was approved by the Texas Legislature and has been funded at over \$9.0 million for 8 years from the Houston Endowment (Hurricane Ike Lessons Learned and Future Steps). A book, “Lessons from Hurricane Ike” was published by TAMU press in June 2012. The SSPEED Center has taken a unique approach to surge mitigation by addressing in bay residual surge impacts related to hurricanes in the Gulf.

**Flood Alert Systems with Radar** - The development of a real-time flood ALERT system (FAS4) for Brays Bayou and the Texas Medical Center in Houston, TX has been completed. The FAS4 currently uses NEXRAD radar for application to flood prediction and real-time flood alert systems. TMC, FEMA, and TXDOT funded FAS improvements from 1998 thru 2010. Analysis of the severe storm impacts in urban watershed areas has been completed using radar rainfall data, combined with GIS techniques for digital terrain and hydraulic modeling in Houston and other coastal areas in Texas. The system worked perfectly during Harvey in Houston.

**Flood Analysis and Mapping** - Monitoring and modeling of radar rainfall and associated hydrology using standard models such as HEC-HMS and HEC-RAS as well as distributed models such as VFLO (VAI). These models have been used to model watersheds all over the U.S. and in flood related legal cases. These models are currently being used for assessing impacts from Hurricane Harvey, the largest measured rainfall in U.S. history over a 5 day period.

**Hazardous Waste Site Evaluation** - Monitoring and modeling of waste plumes associated with 35 hazardous waste sites nationally. Identification of extent of contamination, transport mechanisms, and control strategies. MODFLOW and RT3D modeling of transport and aquifer restoration using withdrawal-treatment and microbial degradation methods. Analysis of hazardous waste sites in California, Texas and Florida.

**COURSES and STUDENTS:**

- CEVE 412 - Hydrology and Watershed Analysis
- CEVE 512 - Hydrologic Design Laboratory
- CEVE 101 - Fundamentals of Civil and Environmental Engineering
- CEVE 415/515 - Water Resources Planning and Management (50%)
- 20 Ph.D. and 70 M.S. degrees since 1975

**RESEARCH STATEMENT:**

Dr. Philip B. Bedient is also Herman Brown Professor of Engineering in the Dept of Civil and Environmental Engineering at Rice University. He teaches and performs research in surface and ground water hydrology, disaster management, and flood prediction systems. He served as Chair of Environmental Engineering from 1992 to 1999. He has directed 60 research projects over the past 42 years, has written over 180 articles in journals and conference proceedings. He is lead author on a text on "Hydrology and Floodplain Analysis" (Prentice Hall, 6th ed., 2018, to appear) used in over 75 universities across the U.S. Dr. Bedient received the Herman Brown endowed Chair of Engineering in 2002 at Rice University. He was elected to Fellow ASCE in 2006 and received the prestigious C.V. Theis Award from the American Institute of Hydrology in 2007. He earlier received the Shell Distinguished Chair in Environmental Science (1988 to 1993).

He is the director of the Severe Storm Prediction Center (SSPEED) at Rice University (since 2007) consisting of a team of seven universities and 15 investigators from Gulf coast universities dedicated to improving storm prediction, education, and evacuation from disaster. The Center was approved by the Texas Legislature and is currently funded by the Houston Endowment (Hurricane Ike Lessons Learned and Future Steps). A book has been developed and published by TAMU press titled "Lessons from Hurricane Ike" published in June 2012. The SSPEED Center has taken a zone approach to developing mitigation strategies and has identified four zones of interest in the Houston-Galveston region: the Houston Ship Channel, West Bayshore, Galveston Island and a Coastal Recreation Area.

Dr. Bedient has over 40 years of experience working on flood and flood prediction problems in the U.S. He has evaluated flood issues in Texas, California, Florida, Louisiana, and Tennessee. He has worked on some of the largest and most devastating floods to hit the U.S. including the San Jacinto River flood of 1994, T.S. Frances in 1998, T.S. Allison in 2001, Hurricane Katrina in 2005, Hurricane Rita in 2005, Hurricane Ike in 2008, and the Nashville, TN flood of 2010. He is currently involved in the analyzing three major floods in Houston, 2015, 2016, and Harvey in 2017. He routinely runs computer models such as HEC-HMS, HEC-RAS, SWMM, and VFLO for advanced hydrologic analysis. He developed one of the first radar based rainfall flood alert systems (FAS-3) in the U.S. for the Texas Medical Center.

The SSPEED Center has put on a number of conferences, meetings, and training courses since 2007. Prominent national speakers have been invited to these conferences, which include attendees from academia, industry, consulting, and emergency managers. These conferences provide a forum for public discussion and response for decision and policy makers, and stakeholders. As a result of this work, we have received a large number of Rice News stories over the past several years, in the form of both video interviews with the media as well as newspaper coverage.

Dr. Bedient has been involved in the technology transfer area for more than two decades through the teaching of short courses for government, university, and private sectors. He has recently organized five conferences on Severe Storm flooding and recovery projects in 2001, 2003, and 2005, 2006, and 2007 on the Rice University campus. In 2008 he organized a new major conference on "Severe Storms Prediction and Global Climate in the Gulf Coast" in October 2008 which hosted speakers who experienced first hand the impacts of both hurricanes Katrina and Ike. SSPEED is now moving its research mission to address post-Harvey impacts and had a conference in FEB 2018. **(over 2500 media hits since Harvey).**

**SURFACE WATER PROJECT (since 1990)**

“Measuring, Mapping and Managing Flood Risk: A Pilot Program in Texas” – Texas A&M University, \$160,000, January 2019 – December 2020

“Cypress Creek Watershed Analysis of Flooding & Storage Options” - Greater Houston Flood Mitigation Consortium, \$121,912, September 2018 – April 30, 2019

“Greens Bayou Watershed Analysis and Resiliency Planning GHFMC Proposal” - Greater Houston Flood Mitigation Consortium, \$233,088, August 2018 – November 2019

“Center to Rebuild Texas” TAMU and the Governor’s Office. \$175,000, April 2018 – July 2019.

“Analysis of Federal Project Residual Flood Areas” Greater Houston Flood Consortium, \$130,000, Jan – Aug 2018.

“FAS4 - Operational Support” – Texas Medical Center, \$96,000 per year, Oct 2017 – present

Flood Warning System for White Oak Bayou, funded by Kinder Inst at Rice U. \$75,000 for 2017-18.

“SSPEED Center Proposal to the Houston Endowment -- Environmental Studies of Various Gal Bay Surge Mitigation Strategies, 2017-2019”, Houston Endowment, \$1,000,000.

Shell Center Award (Padgett and Bedient) -- \$50,000 for one year. 2015-2016.

NSF PIRE award “Coastal Flood Risk Reduction Program: Integrated, Multi-scale Approaches for Understanding how to Reduce Vulnerability to Damaging Events, (2015-2020), \$100,000 per year for 5 years shared with Jamie Padgett. (50%). (Dutch Exchange Program for students).

Shell Center Award "Stress Nexus of Coastlines: Population Development, Infrastructure Security, and Morphological Dynamics of the Upper Texas Gulf Coast" (2014-2016). With others (\$20,000).

“SSPEED Center Proposal to the Houston Endowment 2014-2017,” Houston Endowment \$3,200,000. Last year funding level of \$500,000.

“SSPEED Center Proposal to the Houston Endowment Coastal Integrated”, Houston Endowment, 2011-2014, \$3,195,451

“FAS3- Operational Support”, Texas Medical Center, 2012-2017, \$96,000 per year for 5 years. Supports the operation and research related to TMC Flood Alert System Analysis

“Urban Resilience: Flooding in the Houston-Galveston Area”, Kinder. 2009-2012, \$240,003

“White Oak Bayou BMP Demonstration Project – Cottage Grove Subdivision”, City of Houston, 2009-2013, \$165,000.

“Residential Storm Surge Damage Assessment for Galveston County”, Texas General Land Office (GLO), 2012-2013, \$100,000

“Rice University FEMA: Food Analysis”, Rice, 2011-2012, \$70,000



“Amendment to Expand Development and Validation of the Online Storm Risk Calculator Tool for Public Usage”, City of Houston, 2011, \$388,030

“Hurricane Ike: Lessons Learned and Steps to the Future”, Houston Endowment, 2009-2012, \$1,250,000

“Libya AEL Training Grant”, AECOM, 2008-2010. \$1.7 million over 2 years.

“Texas OEM SSPEED Training” University of Texas, 2008, \$90,000

“Watershed Information Sensing and Evaluation System”. Houston Endowment (with UH), 2007-2010, \$400,000.

“Advanced Flood Alert System for the TXDOT for Bridge Control at 288”. HGAC, 2007-2011 \$200,000.

“Civil and Environmental Engineering for the 21<sup>st</sup> Century”. NSF Dept Reform Grant, 2005-2007, \$100,000.

“CASA – Collaborative Adaptive Sensing of the Atmosphere – the Houston Testbed”. NSF, 2003 – 2009, \$110,000, (\$90,000 for 2006-07).

“FAS2 - Operational Support”, Texas Medical Center, 2003-2012, \$69,000

“Flood Alert System (FAS2) for the Texas Medical Center and Brays Bayou”. FEMA, 2002-2003, \$300,000.

“Multi-Purpose Water Management Technology for the Texas Mexico Border”, Advanced Technology Program, 2000-2001, \$129,000.

“Analysis of Clear Creek Watershed,” Galveston Bay Preservation Foundation, 1999-2000, \$15,000.

“Flood Alert System - Maintenance and Support”. Texas Medical Center, 1998-2002, \$271,000.

“Flood Prediction System for the Texas Medical Center”. Texas Medical Center, 1997-1998, \$262,000.

“The Effects of Changing Water Quality and Market Inefficiencies on Water Resource Allocation in the Lower Rio Grande Valley”. Energy and Environmental Systems Institute, Rice University, 1996-1997, \$12,000.

"Characterization of Laguna Madre Contaminated Sediments", Environmental Protection Agency, 1995, \$68,500.

"Role of Particles in Mobilizing Hazardous Chemicals in Urban Runoff". Environmental Protection Agency, 1992-95, \$240,000. (P. B. Bedient, Co-P.I.).

"Galveston Bay Characterization Report", Galveston Bay National Estuary Program, 1991-1992, \$35,000.

"Characterization of Non-Point Sources and Loadings to Galveston Bay". Galveston Bay National Estuary Program, 1990-1991, \$125,000.

**GROUNDWATER PROJECTS (SINCE 1990)**

“A Large-Scale Experimental Investigation of the Impact of Ethanol on Groundwater Contamination”, (P.J.J. Alvarez – Co-P.I.) American Petroleum Institute, 2004-2007, \$120,000.

“A Large-Scale Experimental Investigation of Impact of Ethanol on Groundwater Contamination”, Gulf Coast Hazardous Substances Research Center, 2004-2005, \$45,000.

“A Large-Scale Experimental Investigation of Impact of Ethanol on Groundwater Contamination”, Gulf Coast Hazardous Substances Research Center, 2003-2004, \$95,000.

"Chlorinated Solvent Impact and Remediation strategies in the Dry Cleaning Industry", Gulf Coast Hazardous Substances Research Center, 2000 – 2003, \$149,400.

"Design Manual for the Extraction of Contaminants from Subsurface Environments", Environmental Protection Agency, 1994-2002, \$4,500,000.

"Development of Data Evaluation/Decision Support System for Bioremediation of Subsurface Contamination", Environmental Protection Agency, 1993-1996, \$450,000.

Shell Distinguished Chair in Environmental Science, Shell Oil Company Foundation, 1988-1993, \$750,000.

**LIST OF HAZARDOUS WASTE SITE PROJECTS (since 2000)**

2001 The Dickson County Landfill, Dickson, TN

2002 Celanese Engineering Resins, Inc., Bishop, TX

2002 GB Biosciences, Houston, TX

2003 DOW Plaquemine, LA

2004 Ciba-Geigy, McIntosh, AL

2004 Amoco, Independence, MO

2004 Olin-Geigy, McIntosh, AL

2006 Crazy Horse Landfill, Monterey County, CA

2008 Mid-Valley Sanitary Landfill, Rialto, CA

2010 Pratt-Whitney, West Palm Beach, FL

2013 Monsanto, Mystic River, MA

2013 San Jacinto River Waste Pits, San Jacinto River, TX

2015 LCP Chemicals Site, Brunswick, GA

2015 North Carolina Steam Stations, NC

**PUBLICATIONS AND PRESENTATIONS****A. Books or Related Chapters**

1. **Bedient, P. B. and Huber, W. C. (2018). "Hydrology and Floodplain Analysis", 6th Ed. Pearson, January 2018, 760 pages.**
2. Fang, Z., Sebastian A., and Bedient, P.B. 2014. "*Modern Flood Prediction and Warning Systems.*" Handbook of Engineering Hydrology: Fundamentals and Applications (Chapter 21), Vol. 1, Taylor & Francis Inc. ISBN-10:1466552417.
3. Bedient, P. B. and W. C. Huber, 2012, "*Hydrology and Floodplain Analysis*", 5th Ed. Prentice-Hall Publishing Co., Upper Saddle River, NJ, February 2012, 800 page textbook.
4. Bedient, P. B., 2012 "*Lessons learned from Hurricane Ike*" Ed. Philip Bedient. College Station, TX: Texas A&M University Press, College Station, TX: 2012, 194 Pages
5. Rifai H.S., Borden R.C., Newell C.J. and Bedient P.B., "*Modeling Remediation of Chlorinated solvent plumes*" In Situ Remediation of Chlorinated solvent Plumes, Chapter 6, H.F. Stroo, C.H. Ward Editors, Springer, N.Y. 2010, 145 pp.
6. Fang, Z., Safiolea, E., Bedient, P.B. (2006) "*Enhanced Flood Alert and Control Systems for Houston.*" In Chapter 16, Coastal Hydrology and Processes, Ed. By Vijay P. Singh and Y. Jun Xu, Water Resource Publications, LLC, pp. 199-210
7. Capiro, N.L. and Bedient P.B. "*Transport of Reactive Solute in Soil and Groundwater*" The Water Encyclopedia (2005): 524-531.
8. Horsak, R.D., Bedient, P.B., Thomas, F.B., and Hamilton, C. "*Pesticides*", Environmental Forensics (2005).
9. Thompson, J.F. and Bedient, P.B. "*Urban Storm Water Design and Management,*" The Engineering Handbook, Chapter 94, CRC Press, 2004, 21 pp.
10. Bedient, P. B., Rifai H. S., and Newell C. J., "*Ground Water Contamination: Transport and Remediation*", 2<sup>nd</sup> Ed. PTR Publ., Upper Saddle River, NJ, 1999, 605 pages.
11. Charbeneau, R. J., Bedient, P. B. and Loehr R. C., "*Groundwater Remediation*", Technomic Publishing Co., Inc., Lancaster, PA 1992, 188 pages.

**B. Peer Reviewed Journal Publications (since 1990 out of a total of 165)**

1. Gori, A., Gidaris, I., Elliott, J., Padgett, J., Loughran, K., Bedient, P., Panakkal, P., and Juan, A. "Accessibility and Recovery Assessment of Houston's Roadway Network due to Fluvial Flooding during Hurricane Harvey." Natural Hazards Review, Vol. 21, Issue 2 (2019/May). DOI: doi:10.1061/(ASCE)NH.1527-6996.0000355
2. Gori, A., Blessing, R., Juan, A., Brody, S., & Bedient, P. "Characterizing urbanization impacts on floodplain through integrated land use, hydrologic, and hydraulic modeling." Journal of Hydrology, 568(2019/January): 82-95. DOI: 10.1016/j.jhydrol.2018.10.053

3. Bernier, C., Kameshwar, S., Elliott, J. R., Padgett, J. E., & Bedient, P. B. (2018). Mitigation strategies to protect petrochemical infrastructure and nearby communities during storm surge. *Natural Hazards Review*, 19(4) doi:10.1061/(ASCE)NH.1527-6996.0000309
4. Bass, B., Torres, J. M., Irza, J. N., Proft, J., Sebastian, A., Dawson, C., & Bedient, P. (2018). Surge dynamics across a complex bay coastline, Galveston bay, TX. *Coastal Engineering*, 138, 165-183. doi:10.1016/j.coastaleng.2018.04.019
5. Bass, B., & Bedient, P. (2018). Surrogate modeling of joint flood risk across coastal watersheds. *Journal of Hydrology*, 558, 159-173. doi:10.1016/j.jhydrol.2018.01.014
6. Anarde, K. A., Kameshwar, S., Irza, J. N., Nitttrouer, J. A., Lorenzo-Trueba, J., Padgett, J. E., . . . Bedient, P. B. (2018). Impacts of hurricane storm surge on infrastructure vulnerability for an evolving coastal landscape. *Natural Hazards Review*, 19(1) doi:10.1061/(ASCE)NH.1527-6996.0000265
7. Brody, S. D., Sebastian, A., Blessing, R., & Bedient, P. B. (2018). Case study results from southeast Houston, Texas: Identifying the impacts of residential location on flood risk and loss. *Journal of Flood Risk Management*, 11, S110-S120. doi:10.1111/jfr3.12184
8. Bernier, C., Elliott, J. R., Padgett, J. E., Kellerman, F., & Bedient, P. B. (2017). Evolution of social vulnerability and risks of chemical spills during storm surge along the Houston Ship Channel. *Natural Hazards Review*, 18(4) doi:10.1061/(ASCE)NH.1527-6996.0000252
9. Torres, J.M., Bass, B., Irza, J.N., Proft, J., Sebastian, A., Dawson, C., and Bedient, P (2017). Modeling the Hydrodynamic Performance of a Conceptual Storm Surge Barrier System for the Galveston Bay Region. *J. of Waterway, Port, Coastal, and Ocean Engineering*. DOI: 10.1061/(ASCE)WW.1943-5460.0000389.
10. Bass, B., Juan, A., Gori, A., Fang, Z., and Bedient, P. (2016). 2015 Memorial Day Flood Impacts for Changing Watershed Conditions in Houston, TX. *Natural Hazards Review*. DOI: 10.1061/(ASCE)NH.1527-6996.0000241.
11. Juan, A., Hughes, C., Fang, Z., and Bedient, P., 2016. Hydrologic Performance of Watershed-scale Low Impact Development (LID) in a High Intensity Rainfall Region. *Journal of Irrigation and Drainage Engineering*, doi: 10.1061/(ASCE) IR.1943-4774.0001141.
12. Torres, J., Bass, B., Irza, N., Fang, Z., Proft, J., Dawson, C., Kiani, M., and Bedient, P (2015). Characterizing the hydraulic interactions of hurricane storm surge and rainfall-runoff for the Houston-Galveston region. *Coastal Engineering* 106, 7-19. DOI: <http://dx.doi.org/10.1016/j.coastaleng.2015.09.004>.
13. Juan, A, Fang, Z., and Bedient, P.B. "Developing a Radar-Based Flood Alert System for Sugar Land, Texas." *Journal of Hydrologic Engineering* (2015).
14. Brody, S.D., Sebastian, A., Blessing, R., & Bedient, P.B. (2015). Case-study results from southeast Houston, Texas: Identifying the impacts of residential location on flood risk and loss. *Journal of Flood Risk Management*, (accepted for publication). doi: 10.1111/jfr3.12184
15. Fang, N., Dolan G., Sebastian, A., & Bedient, P.B. (2014). Case Study of Flood Mitigation and Hazard Management at the Texas Medical Center in the Wake of Tropical Storm Allison in 2001. *ASCE Natural Hazards Review*, 15(3). doi: 10.1061/(ASCE)NH.1527-6996.0000139.

16. Christian, J, Fang, Z., Torres, J., Deitz, R. and Bedient, P.B. "Modeling the Hydraulic Effectiveness of a Proposed Storm Surge Barrier System for the Houston Ship Channel during Hurricane Events." *Natural Hazards Review* 16, no. 1 (2014): 04014015
17. Burleson, Daniel W., Hanadi S. Rifai, Jennifer K. Proft, Clint N. Dawson, and Philip B. Bedient. "Vulnerability of an industrial corridor in Texas to storm surge." *Natural Hazards* 77, no. 2 (2015): 1183-1203.
18. Sebastian, A., Proft, J., Dawson, C., & Bedient, P.B. (2014). Characterizing hurricane storm surge behavior in Galveston Bay using the SWAN+ADCIRC model. *Coastal Engineering*, 88, 171-181. doi: <http://dx.doi.org/10.1016/j.coastaleng.2014.03.002>.
19. Brody, S.D., Blessing, R., Sebastian, A., & Bedient, P.B. (2014). Examining the impact of land use/land cover characteristics on flood losses. *Journal of Environmental Planning and Management*, 57(8), 1252-1265. doi: 10.1080/09640568.2013.802228.
20. Brody, S.D., Blessing, R., Sebastian, A., and Bedient, P.B. (2013). "Delineating the Reality of Flood Risk and Loss in Southeast, TX." *ASCE Natural Hazards Review*, 14, 89-97. doi: 10.1061/(ASCE)NH.1527-6996.0000091.
21. Fang, Z., Sebastian A., and Bedient, P.B. 2014. "Modern Flood Prediction and Warning Systems." *Handbook of Engineering Hydrology: Fundamentals and Applications* (Chapter 21), Vol. 1, Taylor & Francis Inc. ISBN-10:1466552417.
22. Teague, A., J. Christian, and P. Bedient. (2013) "Use of Radar Rainfall in an Application of Distributed Hydrologic Modeling for Cypress Creek Watershed, Texas". *Journal of Hydrologic Engineering*. DOI: 10.1061/(ASCE)HE.1943-5584.000056.
23. Doubleday, G., Sebastian, A., Luttenschlager, T., and Bedient, P.B. (2013). "Modeling Hydrologic Benefits of Low Impact Development: A Distributed Hydrologic Model of The Woodlands, TX." *Journal of American Water Resources*, 1-13. doi: 10.1111/jawr.12095.
24. Christian, J., A. Teague, L. Dueñas-Osario, Z. Fang, and P. Bedient, (2012). "Uncertainty in Floodplain Delineation: Expression of Flood Hazard and Risk in a Gulf Coastal Watershed." *Journal of Hydrological Processes*, doi: 10.1002/hyp.9360.
25. Ray, T., Stepinski, E., Sebastian, A., Bedient, P.B. (2011) "Dynamic Modeling of Storm Surge and Inland Flooding in Texas Coastal Floodplain" ", *Journal of Hydraulic Engineering, ASCE*, Vol. 137, No.10, October 2011, ISSN 0733-9429/2011/10-1103-1110
26. Fang, Z., Bedient, P. B., and Buzcu-Guven, B. (2011). "Long-Term Performance of a Flood Alert System and Upgrade to FAS3: A Houston Texas Case Study". *Journal of Hydrologic Engineering, ASCE* Vol. 16, No. 10, October 1, 2011, ISSN 1084-0699/2011/10-818-828.
27. Teague, A., Bedient, P. and Guven, B. (2010). "Targeted Application of Seasonal Load Duration Curves using Multivariate Analysis in Two Watersheds Flowing into Lake Houston" (JAWRA-10-0003-P.R1). *Journal of American Water Resources Association*. Accepted.
28. Fang, Z, Zimmer, A., Bedient, P. B, Robinson, H., Christian, J., and Vieux, B. E. (2010). "Using a Distributed Hydrologic Model to Evaluate the Location of Urban Development and Flood

- Control Storage". *Journal of Water Resources Planning and Management*, ASCE, Vol. 136, No. 5, September 2010, ISSN 0733-9496/2010/5-597-601.
29. Fang, Z., Bedient, P. B., Benavides J.A, and Zimmer A. L. (2008). "Enhanced Radar-based Flood Alert System and Floodplain Map Library". *Journal of Hydrologic Engineering*, ASCE, Vol. 13, No. 10, October 1, 2008, ISSN 1084-0699/2008/10-926-938.
  30. Gomez, D. E., De Blanc, P. C., Rixey, W., Bedient, P.B., Alvarez, P. J.J. (2008), "Evaluation of Benzene Plume Elongation Mechanisms Exerted by Ethanol Using RT3D with a General Substrate Interaction Module" *Water Resource Research Journal*, Vol. 44, May.
  31. Rifai, H.S., Borden, R. C., Newell, C. J., and Bedient, P.B. "Modeling Dissolved Chlorinated Solvents in Groundwater and Their Remediation," in SERDP monograph on Remediation of Dissolved Phase Chlorinated Solvents in Groundwater, (accepted) 2007.
  32. Bedient, P. B., Holder, A., and Thompson, J. F., and Fang, Z. (2007). "Modeling of Storm water Response under Large Tailwater Conditions – Case Study for the Texas Medical Center". *Journal of Hydrologic Engineering*, Vol. 12, No. 3, May 1, 2007.
  33. Capiro, N.L., Stafford, B.P., Rixey, W.G., Alvarez, P.J.J. and Bedient, P.B. "Fuel-Grade Ethanol Transport at the Water Table Interface in a Pilot-Scale Experimental Tank" *Water Research*, 41(3), pp. 656-654, 2007.
  34. Bedient, P.B., Rifai, H.S., Suarez, M.P., and Hovinga, R.M. "Houston Water Issues" Chapter in *Water for Texas*. Jim Norwine and J.R. Giardino, Eds. pp. 107-121, 2005.
  35. Characklis, G.W., Griffin, R.C., and Bedient, P.B. "Measuring Long-term Benefits of Salinity Reduction" *Journal of Agricultural and Resource Economics*, 30 (1) (2005): 69-93.
  36. Bedient, P.B., Horsak, R.D., Schlenk, D., Hovinga, R.M., and Pierson, J.D. "Environmental Impact on Fipronil to Louisiana Crawfish Industry" *Environmental Forensics* (2005): 289-299.
  37. Characklis, G. W., Griffin, R.C., and Bedient, P.B. "Measuring the Long-term Benefits of Salinity Reduction" *Journal of Agricultural and Resource Economics*, 30(1), pp.69-93, 2005.
  38. Vieux, B.E. and Bedient, P.B. "Assessing urban hydrologic prediction accuracy through event reconstruction" *Journal of Hydrology*, 299(3-4), pp. 217-236. Special Issue on Urban Hydrology, 2004.
  39. Thompson, J.F. and Bedient, P.B. "Urban Storm Water Design and Management" *The Engineering Handbook*, Chapter 94, CRC Press, 2004, 21 pp.
  40. Capiro, N.L. and Bedient P.B. "Transport of Reactive Solute in Soil and Groundwater" *The Encyclopedia of Water*, John Wiley and Sons, Inc., New York, NY, USA pp. 524-531, 2005.
  41. Bedient, P.B., Holder, A., and Benavides, J. "Advanced Analysis of T.S. Allison's Impacts" submitted to *Jn. of American Water Resources Assn.*, 2004.
  42. Bedient, P. B., A. Holder, J. Benavides, and B. Vieux "Radar-Based Flood Warning System applied to TS Allison, *ASCE Journal of Hydrologic Engineering*, 8(6), pp 308-318, Nov, 2003.
  43. Glenn, S., Bedient, P.B., and B. Vieux "Ground Water Recharge Analysis Using NEXRAD in a GIS Framework" submitted to *Ground Water*, October 2002.
  44. Bedient, P.B., Vieux, B.E., Vieux, J.E., Koehler, E.R., and H.L. Rietz "Mitigating Flood Impacts of Tropical Storm Allison" accepted by *Bulletin of American Meteorological Society*, 2002.
  45. El-Beshry, M., Gierke, J.S., and P.B. Bedient "Practical Modeling of SVE Performance at a Jet-Fuel Spill Site" *ASCE Journal of Environmental Engineering* pp. 630-638, (127) 7, July 2001.
  46. El-Beshry, M.Z., Gierke, J.S., and P.B. Bedient "Modeling the Performance of an SVE Field Test" in Chapter 7, *Vadose Zone Science and Technology Solutions*, Brian B. Looney and Ronald W. Falta Editors, Vol. II, pp. 1157-1169, (2000).

47. Rifai, H.S., Brock, S.M. Ensor, K.B., and P.B. Bedient "Determination of Low-Flow Characteristics for Texas Streams" ASCE Journal of Water Resources Planning and Management, (126)5, pp.310-319, September-October 2000.
48. Bedient, P.B., Hoblit, B.C., Gladwell, D.C., and B.E. Vieux "NEXRAD Radar for Flood Prediction in Houston" ASCE Journal of Hydrologic Engineering, 5(3), pp. 269-277, July 2000.
49. Hamed, M.M., Nelson, P.D., and P.B. Bedient "A Distributed Site Model for Non-equilibrium Dissolution of Multicomponent Residually Trapped NAPL" Environmental Modeling and Software, (15), pp. 443-450, September 2000.
50. Holder, A.W., Bedient, P.B., and C.N. Dawson "FLOTRAN, a Three-dimensional Ground Water Model, with Comparisons to Analytical Solutions and Other Models" Advances in Water Resources, pp. 517-530. 2000.
51. Rifai, H.S., Bedient, P.B., and G.L. Shorr "Monitoring Hazardous Waste Sites: Characterization and Remediation Considerations" Journal of Environmental Monitoring, 2(3), pp. 199-212, June 2000.
52. Hoblit, B.C., Baxter, E.V., Holder, A.W., and P.B. Bedient "Predicting With Precision" ASCE Civil Engineering Magazine, 69(11), pp. 40-43, November 1999.
53. Bedient, P.B., Holder, A.W., Enfield, C.G., and A.L. Wood "Enhanced Remediation Demonstrations at Hill Air Force Base: Introduction" Innovative Subsurface Remediation: Field Testing of Physical, Chemical, and Characterization Technologies, Mark L. Brusseau, et al., eds., pp. 36-48, American Chemical Society, Washington, DC, 1999.
54. Holder, A.W., Bedient, P.B., and J.B. Hughes "Modeling the Impact of Oxygen Reaeration on Natural Attenuation" Bioremediation Journal, 3(2): 137-149, June 1999.
55. Characklis, G.W., Griffin, R.C., and P.B. Bedient "Improving the Ability of a Water Market to Efficiently Manage Drought" Water Resources Research, (35) 3, 823-831, March 1999.
56. Vieux, B.E. and P.B. Bedient "Estimation of Rainfall for Flood Prediction from WSR-88D Reflectivity: A Case Study, 17-18 October 1994" Weather and Forecasting, 1998 American Meteorological Society, 13:2, 407-415, June 1998.
57. Bedient, P.B. "Hydrology and Transport Processes" Subsurface Restoration, C.H. Ward, J.A. Cherry and M.R. Sclaf, editors, Ann Arbor Press, Chelsea, MI, 59-73, 1997.
58. Hamed, M.M. and P.B. Bedient "On the Performance of Computational Methods for the Assessment of Risk from Ground-Water Contamination" Ground Water, 35(4), 638-646, July-August 1997.
59. Hamed, M.M. and P.B. Bedient "On the Effect of Probability Distributions of Input Variables in Public Health Risk Assessment" Risk Analysis, 17(1), 97-105, 1997.
60. Hamed, M.M., Bedient, P.B., and J.P. Conte "Numerical Stochastic Analysis of Groundwater Contaminant Transport and Plume Containment" Journal of Contaminant Hydrology, 1996, 24 pp.
61. Hamed, M.M., Bedient, P.B., and C.N. Dawson "Probabilistic Modeling of Aquifer Heterogeneity Using Reliability Methods" Advances in Water Resources, 19(5), 277-295, 1996.
62. Sweed, H., Bedient, P.B., and S.R. Hutchins "Surface Application System for In-Situ Bioremediation: Site Characterization and Modeling" Groundwater Journal, 34(2), 211-222, 1996.
63. Hamed, M.M., Conte, J.P., and P.B. Bedient "Uncertainty Analysis of Subsurface Transport of Reactive Solute Using Reliability Methods" Groundwater Models for Resources Analysis and Management, CRC Press, Inc., Chapter 8:123-135 1995.
64. Hamed, M.M., Conte, J.P., and P.B. Bedient "Probabilistic Screening Tool for Groundwater



- Contamination Assessment" ASCE Journal of Environmental Engineering, 121(11): 767-775, (1995).
65. Rifai, H.S. and P.B. Bedient "A Review of Biodegradation Models: Theory and Applications" Groundwater Models for Resources Analysis and Management, CRC Press, Inc., Chapter 16:295-312 (1995).
  66. Rifai, H. S., Newell, C. J., Bedient, P.B., Shipley, F.S., and R.W. McFarlane, The State of the Bay, The Galveston Bay National Estuary Program, Webster, TX, 232 pp. (1994).
  67. Rifai, H.S. and P.B. Bedient "Modeling Contaminant Transport and Biodegradation in Ground Water" Advances in Environmental Science Groundwater Contamination, Volume I: Methodology and Modeling, Springer-Verlag, New York, NY (1994).
  68. Bedient, P.B. and H.S. Rifai "Modeling in Situ Bioremediation" In Situ Bioremediation, When Does It Work?" National Academy Press, pp. 153-159 (1993).
  69. Rifai, H. S., Bedient, P.B., Hendricks, L.A., and K. Kilborn "A Geographical Information System (GIS) User Interface for Delineating Wellhead Protection" Ground Water, 31:3, pp. 480-488 (1993).
  70. H. S. Rifai, Newell, C. J., and P.B. Bedient "Getting to the Nonpoint Source with GIS" Civil Engineering, June, pp. 44-46 (1993).
  71. H. S. Rifai, Newell, C. J., and P.B. Bedient "GIS Enhances Water Quality Modeling" GIS World, August, pp. 52-55 (1993).
  72. Bedient, P.B., Schwartz, F.W., and H.S. Rifai "Hydrologic Design for Groundwater Pollution Control" Handbook of Hydrology, McGraw Hill, pp. 29.1-29.47 (1993).
  73. Wise, W.R., Robinson, G.C., and P.B. Bedient "Chromatographic Evidence for Nonlinear Partitioning of Aromatic Compounds Between Petroleum and Water" Ground Water, 30(6): 936-944. (Nov. - Dec. 1992).
  74. Charbeneau, R.J., Bedient, P.B., and R.C. Loehr, Groundwater Remediation, Technomic Publishing Co., Inc., Lancaster, PA, 188 pages (1992).
  75. Bedient, P.B. and H.S. Rifai "Ground Water Contaminant Modeling for Bioremediation: A Review" Journal of Hazardous Materials, 32:225-243 (1992).
  76. Kilborn, K., Rifai, H.S., and P. B. Bedient "Connecting Groundwater Models and GIS" Geo Info Systems, pp. 26-31, (February 1992).
  77. Rifai, H. S. and P. B. Bedient "Modeling Contaminant Transport and Biodegradation in Ground Water" To be published in Textbook: Advances in Environmental Science Groundwater Contamination, Volume I: Methodology and Modeling, Springer Verlag, (In Press) (September 1991).
  78. Newell, C.J., Rifai, H.S., and P.B. Bedient "Characterization of Non-Point Sources and Loadings to Galveston Bay" Galveston Bay National Estuary Program, Houston, Texas, 150 pp (October 1991).
  79. Rifai, H.S., Long, G.P., and P.B. Bedient "Modeling Bioremediation: Theory and Field Application" In Situ Bioreclamation Applications and Investigations for Hydrocarbon and Contaminated Site Remediation, Ed. by R. E. Hinchey and R. F. Olfenbuttel, Battelle Memorial Institute, Butterworth-Heinemann, Boston, (1991).
  80. Kilborn, K., Rifai, H.S., and P.B. Bedient "The Integration of Ground Water Models with Geographic Information Systems (GIS)" 1991 ACSM/ASPRS 10 Annual Convention, Baltimore, Maryland, In Technical Papers, vol. 2, pp. 150-159, (March 1991).
  81. Wise, W.R., Chang, C.C., Klopp, R.A., and P. B. Bedient "Impact of Recharge Through Residual Oil Upon Sampling of Underlying Ground Water" Ground Water Monitoring Review, pp. 93-100



(Spring 1991).

82. Rifai, H.S. and P.B. Bedient "Comparison of Biodegradation Kinetics with an Instantaneous Reaction Model for Ground Water" *Water Resource. Res.* 26:637-645 (1990).
83. Newell, C.J., Hopkins, L.P., and P.B. Bedient "A Hydrogeologic Database for Ground Water Modeling" *Ground Water* 28:703-714 (1990).
84. Newell, C.J., Haasbeek, J.F., and P.B. Bedient "OASIS: A Graphical Decision Support System for Ground Water Contaminant Modeling" *Ground Water* 28:224-234 (1990).

#### **Conference Proceedings and Other Technical Publications (since 1995)**

1. Panakka, P., Juan, A., Garcia, M., Padgett, J. E., & Bedient, P. (2019). Towards enhanced response: Integration of a flood alert system with road infrastructure performance models. Paper presented at the Structures Congress 2019: Buildings and Natural Disasters - Selected Papers from the Structures Congress 2019, 294-305. doi:10.1061/9780784482223.029
2. Figlus, J., Anarde, K., Dellapenna, T., & Bedient, P. (2018). Coastrr: Coastal storm rapid response measurements of hurricane harvey impact and recovery on two texas barrier islands. Paper presented at the Proceedings of the Coastal Engineering Conference, 36 (2018)
3. Balomenos, G. P., Kameshwar, S., Bass, B., Padgett, J. E., & Bedient, P. (2018). Vulnerability of bridges exposed to coastal hazards and climate change. Paper presented at the Maintenance, Safety, Risk, Management and Life-Cycle Performance of Bridges - Proceedings of the 9th International Conference on Bridge Maintenance, Safety and Management, IABMAS 2018, 1643-1649.
4. Juan, A., Fang, Z., and Bedient, P. B. (2012). "Flood Warning Indicator: Establish a Reliable Radar-Based Flood Warning System for Sugar Land, Texas", American Geophysical Union (AGU) 2012 Fall Meeting, San Francisco, CA, December 3-7.
5. Deitz, R., Christian, J. K., Wright, G., Fang, Z., and Bedient, P. B. (2012). "Linkage of Rainfall-Runoff and Hurricane Storm Surge in Galveston Bay", American Geophysical Union (AGU) 2012 Fall Meeting, San Francisco, CA, December 3-7.
6. Bedient, P. B., Doubleday, G., Sebastian, A., and Fang, Z. (2012). "Distributed Hydrologic Modeling of LID in the Woodlands, Texas", American Geophysical Union (AGU) 2012 Fall Meeting, San Francisco, CA, December 3-7.
7. Burcham, M., Bedient, P. B., McGuire, T., Adamson, D., New Ch., (2012) Occurrence of Sustained Treatment Following Enhanced Anaerobic Bioremediation at Chlorinated Solvent Sites<sup>[1]</sup><sub>SEP</sub>, AGU Fall Meeting, San Francisco, California, December 3-7 2012
8. Fang, Z. and Bedient, P., Performance Evaluation of a NEXRAD-Based Flood Warning during Recent Events in 2012<sup>[1]</sup><sub>SEP</sub>, AGU Fall Meeting, San Francisco, California, December 3-7 2012
9. Juan, A., Fang, Z. and Bedient, P., Radar-based Flood Warning Indicator for the Upper Oyster Creek Watershed in Sugar Land, Texas<sup>[1]</sup><sub>SEP</sub>, AGU Fall Meeting, San Francisco, California, December 3-7 2012
10. Environmental and Water Res. Inst. (EWRI) 2012 Congress, Organized three sessions for SSPEED research results. Albuquerque, New Mexico, May 20-24 2012.
11. Fang, Z. and Bedient, P. B. (2012). "Creating Flood Alert Systems in Coastal Areas", SSPEED Conference – Gulf Coast Hurricanes: Mitigation and Response, Houston, Texas, April 10.

12. Fang, Z. and Bedient, P. B. (2012). "Advanced Radar-Based Flood Warning System for Urban Areas and its Performance Evaluation", SSPEED Conference – Gulf Coast Hurricanes: Mitigation and Response, Houston, Texas, April 11.
13. Teague, A. and Bedient, P. B. (2011). "Visualization of Hydrologic Simulations with Pollutant Load Estimation for Cypress Creek Watershed, Houston, Texas". 2011 World Environmental and Water Resources Congress. Palm Springs California 22-26 May 2011.
14. Christian, J. K., Fang, Z., and Bedient, P. B. (2011). "Probabilistic Floodplain Delineation", 2011 World Environmental and Water Resources Congress, Palm Springs, California. May 22-26
15. Fang, Z., Juan, A., Bedient, P. B., Kumar, S., and Steubing, C. (2011). "Flood Warning Indicator: Establishing a Reliable Radar-Based Flood Warning System for the Upper Oyster Creek Watershed", ASCE/TFMA, TFMA 2011 Annual Conference, Sugar Land, Texas, April 11- 14.
16. Bedient, P. B. and Fang, Z. (2010). "Advanced Radar-based Flood Warning System for Hurricane-prone Urban Areas and Performance during Recent Events", 2nd International Conference on Flood Recovery, Innovation and Response (FRIAR), Milano, Italy, May 26-28.
17. Fang, Z., Juan, A., Bedient, P. B., Kumar, S., and Steubing, C. (2010). "Flood Alert System for Upper Oyster Creek Watershed in Sugar Land, Texas using NEXRAD, HEC-HMS, HEC-RAS, and GIS", ASCE/TFMA, TFMA 2010 Annual Conference, Fort Worth, Texas, June 7- 10.
18. Fang, Z. and Bedient, P. B. (2010). "Radar Applications in Flood Warning System for an Urban Watershed in Houston, Texas", Remote Sensing and Hydrology 2010 Symposium - Special Session on Flood Forecasting and Management with Remote Sensing and GIS, Jackson Hole, WO, September 27 -30.
19. Bedient, P. B., Fang, Z., and Vieux, B. E. (2010). "Radar-based Flood Warning System for the Texas Medical Center and Performance Evaluation", National Flood Workshop, Houston, Texas, October 24-26.
20. Teague, A. and Bedient, P. 2010. "Distributed Modeling of Water Quality in Cypress Creek Watershed, Houston, Texas". 21st Century Watershed Technology: Improving Water Quality and the Environment, EARTH University, Costa Rica, February 21-24, 2010.
21. Teague, A. and Bedient, P. 2010. "Visualization of Hydrologic Simulations in Support of Water Quality Applications for Cypress Creek, Houston, Texas". Conference Proceedings. Annual Water Resources Conference, American Water Resources Association. November 1-4, 2010, Philadelphia, PA.
22. Teague, A. and Bedient, P. 2010. "Distributed Water Quality Modeling for a Drinking Water Source Watershed for the City of Houston, Texas". Conference Proceedings. World Environmental and Water Resources Congress. May 16-20, 2010, Providence, RI.
23. Fang, Z. and Bedient, P.B. (2009). "Radar-based Flood Warning System for Houston and Its Performance Evaluation". American Geophysical Union (AGU) 2009 Fall Meeting, December 14-18, San Francisco, CA.
24. Fang, Z. and Bedient, P.B. (2009). "Radar-based Flood Alert System for Coastal Area and Collaborated Efforts for Disaster Prevention and Risk Management". IRCD 34th Annual Natural Hazards Research and Applications Workshop – Hazards and the Economy: Challenges and Opportunity, July 15-18, Boulder, CO.
25. Fang, Z. and Bedient, P.B. (2009). "Flood Inundation Prediction and Performance during Hurricane Ike". Proceedings of World Environmental & Water Resources Congress 2008,

Environmental and Water Resources Institute (EWRI), ASCE, Kansas City, Missouri, May 17-21.

26. Robinson, H., Fang, Z. and Bedient, P.B. (2009). "Distributed Hydrologic Modeling of the Yuna River Watershed in the Dominican Republic". Proceedings of World Environmental & Water Resources Congress 2008, Environmental and Water Resources Institute (EWRI), ASCE, Kansas City, Missouri, May 17-21.
27. Ray, T., Fang, Z., and Bedient, P.B. (2009). "Assessment of Flood Risk Due to Storm Surge in Coastal Bayous Using Dynamic Hydraulic Modeling". Proceedings of World Environmental & Water Resources Congress 2008, Environmental and Water Resources Institute (EWRI), ASCE, Kansas City, Missouri, May 17-21.
28. Fang, Z. and Bedient, P.B. (2009). "Advanced Radar-based Flood Forecasting Systems for a Highly Urbanized Coastal Area and SSPEED Center", ASCE/TFMA Flood Awareness and Flood Response Workshop, April 29, San Marcos, TX.
29. Fang, Z. and Bedient, P.B. (2009). "Flood Warning Systems for Urban Flooding". Grand Challenges in Coastal Resiliency I: Transforming Coastal Inundation Modeling to Public Security, January 20-21, Baton Rouge, LA.
30. Fang, Z. and Bedient, P.B. (2008). "NEXRAD Radar-based Hydraulic Flood Prediction System for a Major Evacuation Routes in Houston". American Geophysical Union 2008 Fall Meeting, December 15-19, San Francisco, CA.
31. Fang, Z. and Bedient, P.B. (2008). "Advanced Flood Alert System with Hydraulic Prediction for a Major Evacuation Route in Houston". Proceedings of American Water Resources Association (AWRA) Annual Conference 2008, New Orleans, Louisiana, November 17-20.
32. Fang, Z. and Bedient, P.B. (2008). "Flood Inundation Prediction and Performance during Hurricane Ike". Proceedings of Severe Storm Prediction and Global Climate Impact in the Gulf Coast Conference 2008, Houston, Texas, October 28-31.
33. Bedient, P.B. and Fang, Z. (2008). "Predicting and Managing Severe Storms in the Gulf Coast through University Research". Proceedings of Severe Storm Prediction and Global Climate Impact in the Gulf Coast Conference 2008, Houston, Texas, October 28-31.
34. Robinson, H., Fang, Z. and Bedient, P.B. (2008). "Distributed Hydrologic Model Development in the Topographically Challenging Yuna River Watershed, Dominican Republic". Proceedings of Severe Storm Prediction and Global Climate Impact in the Gulf Coast Conference 2008, Houston, Texas, October 28-31.
35. Ray, T., Fang, Z. and Bedient, P.B. (2008). "Assessment of Flood Risk Due to Storm Surge in Coastal Bayous Using Dynamic Hydraulic Modeling". Proceedings of Severe Storm Prediction and Global Climate Impact in the Gulf Coast Conference 2008, Houston, Texas, October 28-31.
36. Fang, Z. and Bedient, P.B. (2008). "Floodplain Map Library (FPML): Innovative Method for Flood Warning System for Urban Watershed in Houston, TX". Proceedings of World Environmental & Water Resources Congress 2008, Environmental and Water Resources Institute (EWRI), ASCE, Honolulu, Hawaii, May 13-16.
37. Bedient, P.B., "Foresight Panel on Environmental Effects" Houston-Galveston Area Council, Houston, Texas, February 5, 2008
38. Bedient, P.B., Fang, Z., Hovinga, R. M., "Flood Warning System (FAS<sub>2</sub>) Rice University

Training, Houston, Texas, January 15, 2008

39. Bedient, P.B., Fang, Z., Hovinga, R, M., SSPEED Meeting, Houston, Texas, November 16, 2007
40. Fang, Z. and Bedient, P.B. "Real-time Hydraulic Prediction Tool – Floodplain Map Library (FPML)". American Water Resources Association 2007 Annual Conference, Albuquerque, New Mexico, November 12-15, 2007
41. Fang, Z. and Bedient, P.B. "Enhanced NEXRAD Radar-based Flood Warning System with Hydraulic Prediction Feature: Floodplain Map Library (FPML)". American Geophysical Union 2007 Fall Meeting, San Francisco, CA. December 10-14, 2007
42. Fang, Z. and Bedient, P.B. "The Future of Flood Prediction in Coastal Areas" Severe Storm Prediction, Evacuation, and Education from Disasters Conference, Rice University, Houston Texas, May 8-10, 2007
43. Bedient, P.B. and Fang, Z. "Radar-based Flood Warning System Using Dynamic Floodplain Map Library." Proceedings of World Environmental & Water Resources Congress 2007, Environmental and Water Resources Institute (EWRI), ASCE, Tampa, Florida, May 15-19, 2007
44. Bedient, P.B., and C. Penland "A Radar Based FAS for Houston's Texas Medical Center" IDRC Conference, Davos, Switzerland, Aug 2006.
45. Safiolea, E. and P.B. Bedient "Comparative Analysis of the Hydrologic Impact of Land Use Change and Subsidence in an Urban Environment" Proceedings of AWRA GIS Conference, Houston, TX, May 8-10, 2006.
46. Bedient, P.B., Fang, Z., and R. Hovinga "Prediction for Severe Storm Flood Levels for Houston Using Hurricane Induced Storm Surge Models in GIS Frame" Proceedings of AWRA GIS Conference, Houston, TX, May 8-10, 2006.
47. Fang, Z., Safiolea, E., and P.B. Bedient "Enhanced Flood Alert and Control Systems for Houston" Proceedings of 25<sup>th</sup> American Institute of Hydrology Conference, Baton Rouge, LA, May 21-24, 2006.
48. Gordon, R. and P.B. Bedient "Rice University Engineers Without Borders: An Exercise in International Service Learning" Proceedings of the ASE Education Conference, Chicago, June 18-21, 2006.
49. Gordon, R., Benavides, J.A., Hovinga, R., Whitko, A.N., and P.B. Bedient "Urban Floodplain Mapping and Flood Damage Reduction Using LIDAR, NEXRAD, and GIS" Proceedings of the 2006 AWRA Spring Specialty Conference: GIS and Water Resources IV, Houston, TX, May 8-10, 2006.
50. Fang, Z. and P.B. Bedient "IP2 Houston Flood Alert and Response-2006" CASA Meeting, Estes Park, Co, October 16-17, 2006.
51. Safiolea, E., Bedient, P.B., and B.E. Vieux "Assessment of the Relative Hydrologic Effects of Land Use Change and Subsidence Using Distributed Modeling" (July 2005).
52. Holder, A.W., Hoblit, B., Bedient, P.B., and B.E. Vieux "Urban Hydrologic Forecasting Application Using the NEXRAD Radar in Houston" Proceedings of the Texas Section American Society of Civil Engineers, Austin, TX, pp. 279-288, April 5-8, 2000.

53. Benavides, J.A., Pietruszewski, B., Stewart, E., and P.B. Bedient "A Sustainable Development Approach for the Clear Creek Watershed" Proceedings of the Texas Section American Society of Civil Engineers, Austin, TX, pp. 269-278, April 5-8, 2000.
54. Bedient, P.B., Rifai, H.S., and C.W. Newell "Decision Support System for Evaluating Pump-and-Treat Remediation Alternatives" Pollution Modeling: Vol. 1, Proceedings for Envirosoft 94, November 16-18, 1994, San Francisco, CA, Edited by P. Zannetti, Computational Mechanics Publications, Wessex Inst of Technology, Southampton, UK.
55. Hamed M.M. and P.B. Bedient "Uncertainty Analysis of Natural Attenuation in Groundwater Systems," Proceedings of the In Situ and On-Site Bioremediation Symposium, New Orleans, LA, 1997, 1:43-48.
56. Hamed, M.M., Holder, A.W., and P.B. Bedient "Evaluation of Reaeration Using a 3-D Groundwater Transport Model" Proceedings of the In Situ and On-Site Bioremediation Symposium, New Orleans, LA, 1997, 1:75-80.
57. Holder, A.W., Bedient, P.B., and J.B. Hughes "TCE and 1,2-DCE Biotransformation Inside a Biologically Active Zone" Proceedings of the First International Conference on Remediation of Chlorinated and Recalcitrant Compounds, Monterey, CA, May 18-21, 1:219-224, 1998.
58. Hamed M.M. and P.B. Bedient "Uncertainty Analysis of Natural Attenuation in Groundwater Systems" Proceedings of the In Situ and On-Site Bioremediation Symposium, New Orleans, LA, 1997, 1:43-48.
59. Hamed, M.M., Holder, A.W., and P.B. Bedient "Evaluation of Reaeration Using a 3-D Groundwater Transport Model" Proceedings of the In Situ and On-Site Bioremediation Symposium, New Orleans, LA, 1997, 1:75-80.
60. Hamed, M.M., Bedient, P.B., and J.P. Conte "Probabilistic Modeling of Contaminant Transport in the Subsurface" Proceedings of the International Association of Hydro geologists Conference Solutions '95", Edmonton, Canada, June 4-10, 1995.

#### **Invited Lectures (Recent since 2000)**

1. The Resilience and Adaptation to Climate Risks Workshop: NASA Johnson Space Center and the Houston/Galveston Area, March 8, 2012, Houston, Texas
2. Bedient, P.B., SSPEED Conference. Chair and Organizer, "*Hurricane Ike, Revisited*," September 14, 2009, Houston, Texas.
3. Bedient, P.B., SSPEED Conference. Chair and Organizer, "*Severe Storm Prediction and Global Climate Impact in the Gulf Coast*," Sponsored by American Institute of Hydrology. October 29-31, 2008, Houston, Texas. (Attended by over 150 guests and speakers).
4. Bedient, P.B., SSPEED Conference. Chair and Organizer, "*Severe Storm Prediction and Global Climate Impact in the Gulf Coast*," Sponsored by American Institute of Hydrology. October 29-31, 2008, Houston, Texas. (Attended by over 150 guests and speakers).
5. Bedient, P.B., Robinson, and H., Fang, Z. (2008). "Distributed Hydrologic Model Development in the Topographically Challenging Yuna River Watershed, Dominican Republic". Meeting in Dominican Republic before the President October 20, 2008.
6. Bedient, P.B. (June, 2008) Plan for the Dominican Republic Flood Study, before the Ministers of Education, Environment, and Economic Development.

7. Bedient, P.B. "Advanced Flood Alert Systems in Texas" International Disaster Response Conference, Daves, Switzerland, August 28, 2006.
8. Bedient, P.B. "IP2 Flood Alert System for Houston" CASA Meeting NSF Review, UMASS. April, 2006.
9. Bedient, P.B. "Severe Storm Impacts in the Gulf Coast" Severe Storm Impacts and Disaster Response in Gulf Coast, Houston, Rice University, March 15-16, 2006.
10. Bedient, P.B. "Living with Severe Storms in the Gulf Coast- Scientia Lecture" Rice University, Houston, TX. (September 2005).
11. Bedient, P.B., Fang, Z., Safiolea, E., and B.E. Vieux "Enhanced Flood Alert System for Houston" 2005 National Hydrologic Council Conference: Flood Warning Systems, Technologies and Preparedness, Sacramento, California. (May 16-20)
12. Fang, Z. and Bedient, P.B. "Enhanced Flood Alert and Control Systems for Houston" Proceedings of the 25<sup>th</sup> American Institute of Hydrology Conference: Challenges of Coastal Hydrology and Water Quality. Baton Rouge, Louisiana, May 21-24, 2006.
13. Fang, Z., Bedient, P.B., and R. Hovinga "Prediction of Severe Storm Flood Levels for Houston Using Hurricane Induced Storm Surge Models in a GIS Frame" Proceedings of AWRA 2006 Spring Specialty Conference: GIS and Water Resources IV. Houston, Texas, May 8-10, 2006.
14. Bedient, P.B. "Impacts of Climate Change on Transportation Systems and Infrastructure" Gulf Coast Study, Lafayette, LA. (May 2005)
15. Capiro, N.L., Da Silva, M.L.B., Stafford, B.P., Alvarez, P.J.J., and P.B. Bedient "Changes in Microbial Diversity Resulting from a Fuel-Grade Ethanol Spill" Eighth International Symposium on In Situ and On-Site Bioremediation, Baltimore, MD. (June 2005).
16. Safiolea, E. and P. B. Bedient "Assessment of the Relative Hydrologic Effect of Land Use Change and Subsidence Using Distributed Modeling" EWRI Watershed Management Conference, Williamsburg, VA. (July 9-22, 2005)
17. Capiro, N.L., Stafford, B., He, X., Rixey, W.G., and P.B. Bedient "A Large-Scale Experimental Investigation of Ethanol Impacts on Groundwater Contamination" Presentation at the Fourth International Conference on Remediation of Chlorinated and Recalcitrant Compounds; Monterey, CA; May 2004.
18. Capiro, N.L., Da Silva, M.L.B., Stafford, B.P., Alvarez, P.J.J., and P.B. Bedient "Changes in Microbial Diversity Resulting from a Fuel-Grade Ethanol Spill" Accepted for Presentation at The Eighth International Symposium on In Situ and On-Site Bioremediation; Baltimore, MD. June 2005.
19. Safiolea, E. and P.B. Bedient "Analysis of Altered Drainage Patterns and Subsidence Impact Using a Distributed Hydrologic Model" AWRA Annual Water Resources Conference in Orlando FL, November 2004.
20. Safiolea, E. and Philip B. Bedient "Assessment of the Relative Hydrologic Effect of Land Use Change and Subsidence using Distributed Modeling" EWRI Watershed Management Conference in Williamsburg VA, Jul19-22, 2005.
21. Bedient, P.B. and J.A. Benavides "Use of QPE and QPF for Flood Alert (FAS2) in the Houston, TX Test Bed" CASA NSF ERC Conference, "Estes Park, CO, October, 2004.



22. Capiro, N.L., Adamson, D.T., McDade, J.M., Hughes, J.B., and P.B. Bedient "Spatial Variability of Dechlorination Activity Within a PCE DNAPL Source Zone" Presentation The 7th International Symposium In Situ and On-Site Bioremediation; Orlando, FL; June 2003
23. Benavides, J.A. and P.B. Bedient "Improving the Lead-Time and Accuracy of a Flood Alert System in an Urban Watershed" 2003 AWRA Annual Conference, San Diego, California, November 2003.
24. Whitko, A.N. Bedient, P.B., and S. Johnson "Sustainable Flood Control Strategies in the Woodlands – Thirty Years Later" 2003 AWRA Annual Conference, San Diego, California, November 2003.
25. Safiolea E., Hovinga, R., and P.B. Bedient " Impact of Development Patterns on Flooding in Northwest Houston using LIDAR Data" 2003 AWRA Annual Conference, San Diego, California, November 2003
26. Benavides, J.A. and P.B. Bedient "Improving the Performance of a Flood Alert System Designed for a Rapidly Responding Urban Watershed" 2003 Conference on Flood Warning Systems Technologies and Preparedness, Dallas, Texas. October 2003.
27. Bedient, P.B., Holder, A., and Baxter Vieux "A Radar-Based Flood Alert System (FAS) Designed for Houston, TX" *International Conference on Urban Storm Drainage*, Portland, OR, September 2002.
28. Holder, A., Stewart, E., and P.B. Bedient "Modeling an Urban Drainage System with Large Tailwater Effects under Extreme Rainfall Conditions" *International Conference on Urban Storm Drainage*, Portland, OR, September 2002.
29. Glenn, S., Bedient, P.B., and B. Vieux "Analysis of Recharge in Ground Water Using NEXRAD in a GIS Format" *AWRA Summer Specialty Conference*, Keystone, CO, July, 2002.
30. Bedient, P.B. "Flood ALERT System (FAS) for Brays Bayou and the TMC" T.S. Allison: A Brays Bayou Event, Rice University Conference Presentation, and November 13, 2001.
31. Bedient, P.B. "Flood ALERT System for the Texas Medical Center" Hurricanes and Industry, Houston Conference Presentation, November 7, 2001.
32. Bedient, P.B. and J.A. Benavides "Analyzing Flood Control Alternatives for the Clear Creek Watershed in a Geographic Information Systems Framework" presented at ASCE's EWRI Spring 2001 World Water & Environmental Resources Congress Conference.
33. Hoblit, B.C., Bedient, P.B., B.E. Vieux, and A. Holder "Urban Hydrologic Forecasting: Application Issues Using WSR-88D Radar" *Proceedings American Society of Civil Engineers Water Research, Planning and Management 2000 Conference*, Minneapolis, MN, August 2000.